

### **REMARKS**

This responds to the Office Action mailed on August 18, 2008.

No claims are amended, no claims are canceled, and no claims are added; as a result, claims 1-19, 22-24 and 27-31 are now pending in this application.

#### **§103 Rejection of the Claims**

Claims 1-19 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Knights et al. (2004/0157110) in combination with El-Sayed (U.S. Patent No. 6,090,058) in combination with Womelsdorf (2002/0149002) in combination with Asakawa et al. (2003/0222048) further in combination with Amine et al. (U.S. Patent No. 5,820,790).

The Examiner has failed to provide a *prima facie* case of obviousness as not all elements of the present claims are found in the cited references. Further, the combination of references teaches away from the present invention.

#### **Not All Elements Found in the Cited References**

Claim 1 of the present invention recites, among other things, “forming a nano-particle dispersion comprising; providing between 0.05 wt % and 10 wt % of a charged soluble polymer having a molecular weight of less than 25,000 amu; providing between 0.5 wt % and 10 wt % of a metal component; providing a carrier having between 99.45% and 80% of an organic liquid having a surface tension that is less than water”. The El-Sayed reference does not disclose such concentrations of metal component, charged soluble polymer, and carrier. El-Sayed discloses ratios of capping material to metal ions; however, such ratios do not discuss ratios of carrier with the capping material and metal ions and are therefore not interchangeable with the weight percents of each constituent disclosed in claim 1 of the present invention. However, in a preferred embodiment of El-Sayed, a solution is disclosed that is created by the addition of enough water to 2 mL of 0.01 MK<sub>2</sub>PtCl<sub>4</sub> to make a 250 ml solution of  $8 \times 10^{-5}$  M solution of the salt. The solution of the preferred embodiment of El-Sayed does not read on the weight percents of the metal component, charged soluble polymer, and carrier of claim 1. Furthermore, El-Sayed does not describe the molecular weight of the charged soluble polymer of claim 1, which is

critical to preventing agglomeration of the metal component and allowing the metal component to remain dispersed in the carrier in the weight percentages used in the present claim.

Claim 1 of the present invention recites, among other things, “a method for making an electrode by depositing nano-particles on an object having a microstructure, comprising: forming a nano-particle dispersion...; coating an object with the nano-particle dispersion thereby disposing nano-particles from the nano-particle dispersion on the object and into the microstructure to form an electric conductor, wherein the microstructure is configured to receive and retain the nano-particle dispersion; removing at least a portion of the carrier from the object; forming an electrical circuit using the electric conductor such that electric current flows in at least a portion of a medium using the electric conductor; and connecting the electrical circuit to a load.” The Knights reference does not teach “disposing nano-particles from the nano-particle dispersion on the object and into the microstructure to form an electric conductor, wherein the microstructure is configured to receive and retain the nano-particle dispersion”. The Knights reference discloses that its platinum deposits cannot access the surface in the micropores. In addition, the Asakawa reference also does not teach this step. In Asakawa, platinum is electroplated on a porous layer, not coated with a dispersion on a substrate to form an electric conductor. The microstructures are part of the electrolyte membrane structure and not the coated electrodes. In Biebuyk, the microstructures are integral with the patterning device and used to facilitate transfer of material to be deposited onto a substrate. The microstructures are not on the substrate itself. There is no disclosure on how to use the hydrophobic / hydrophilic surfaces to facilitate deposition along the surface of a microstructure.

The remaining claims are dependent on the discussed independent claims and are believed to be in similarly allowable condition.

Claims 22-24 and 27-31 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Knights et al. (2004/0157110) in combination with El-Sayed (U.S. Patent No. 6,090,058) in combination with Womelsdorf (2002/0149002) in combination with Asakawa et al. (2003/0222048) further in combination with Amine et al. (U.S. Patent No. 5,820,790) still further in combination with Biebuyck et al. (U.S. Patent No. 6,326,058).

Claim 22 of the present invention recites, among other things, “combining selected amounts of a charged soluble polymer, a metal component and a carrier to form a nano-particle

dispersion; providing a substrate that includes micro-features that extend into the substrate, wherein the substrate is hydrophobic in regions external to each of the micro-features; and distributing the nano-particle dispersion onto the substrate so that the nano-particle dispersion is substantially retained within the micro-features, and not in regions external to each of the micro-features.” The cited references do not disclose “distributing the nano-particle dispersion onto the substrate so that the nano-particle dispersion is substantially retained within the micro-features, and not in regions external to each of the micro-features.” The references do not disclose such steps, as discussed above in regard to claim 1. Those arguments are herein incorporated by reference.

Claim 27 of the present invention recites, among other things, “preparing a nano-particle dispersion that includes predetermined amounts of a charged soluble polymer, a metal component and a carrier; and preparing a substrate to receive the nano-particle dispersion, wherein the substrate includes a first portion altered to be non-wettable by the nano-particle dispersion, and a second portion that is wettable by the nano-particle dispersion.” The cited references do not disclose “preparing a substrate to receive the nano-particle dispersion, wherein the substrate includes a first portion altered to be non-wettable by the nano-particle dispersion, and a second portion that is wettable by the nano-particle dispersion.” The references do not disclose such steps, as discussed above in regard to claim 1. Those arguments are herein incorporated by reference.

The remaining claims are dependent on the discussed independent claims and are believed to be in similarly allowable condition.

#### The Combination of References Teach Away from the Claimed Invention

Using the dispersion of EI-Sayed to coat the microstructures of Asakawa teaches away from the present invention. An electroplating or electroless plating process is employed to deposit metal on the microstructures of Asakawa. The process of metal deposition in Asakawa is disclosed as being performed by connecting an electrode to a porous structure having microstructures, immersing the electrode in a plating bath, and passing a current through the electrode, thereby depositing a metal in the porous structure. . The process of metal deposition in Asakawa does not allow for the use of a nano-particle dispersion for metal deposition, as it is

formed by immersing the electrode in a solution and using external electric fields to draw metal ions from the solution for metal deposition. The metal deposition process described in Asakawa would fail to deposit the nano-particles in the colloidal solution of El-Sayed because the metal ions of El-Sayed are stabilized by the capping agent and therefore do not hold sufficient charge to be drawn to the porous layer for deposition.

The combination of El-Sayed with Knights or Asakawa teaches away from the present invention. El-Sayed utilizes water as a carrier, which has a high surface tension. The dispersion of El-Sayed would fail to impregnate the porous structures of Knights or Asakawa, much less the microstructures of the present invention. Although the Amine reference discussed the use of ethyl alcohol as part of an electrode paste to improve coating titanium or copper, one skilled in the art would not look to that reference as an example of low surface tension carriers as it does not discuss the nano-dispersions of the present invention or depositing them in microstructures.

The combination of Biebuyck with Knights or Asakawa also teaches away from the present invention. Biebuyck uses a patterning device to pattern a substrate by filling conduits formed in a transfer region of the device and contacting the substrate with the transfer region. As disclosed in Biebuyck, the formation of the conduits of the patterning device has the advantage that the fluid is shielded from the influences of the environment to avoid pollution or changes in concentration of the fluid due to evaporation, which precludes the at least partial removal of the carrier from the dispersion for deposition of nano-particles on an object or substrate to form the electrode of the present invention.

CONCLUSION

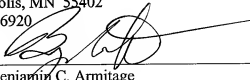
Applicant respectfully submits that the claims are in condition for allowance, and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicant's attorney at 612-373-6920 to facilitate prosecution of this application.

If necessary, please charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

Respectfully submitted,

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**CERTIFICATE UNDER 37 CFR 1.8:** The undersigned hereby certifies that this correspondence is being filed using the USPTO's electronic filing system EFS-Web, and is addressed to: Mail Stop Amendment, Commissioner of Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on this 17<sup>th</sup> day of November 2008.

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